BMW Group Production.
Flexible, Efficient, Innovative.
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1. The Strategy of the BMW Group: Production Follows the Market.

The BMW Group concentrates on those premium segments of the automobile market which reflect the character of the respective brand and show an above-average growth potential. In pursuing this policy, the Company focuses on growth and expansion. Growth means growing with the existing model portfolio in all markets where the BMW Group is already active. Expansion takes the BMW Group a step further, launching new products
for entering new segments and new markets.

The strategy in production is equally clear and straightforward:
Production follows the Market. Apart from the local production of cars as such, this strategy also serves other purposes:

- **Opening and developing the market:** Local production plants facilitate access to new markets with a long-term growth potential.

  BMW pursues this strategy above all in markets which, through high import duties, create barriers to the importation of completely built-up cars, thus preventing any greater penetration of the marketplace. Completely knocked down (CKD) assembly plants on location serve to circumvent this barrier, allowing BMW to offer products at competitive prices. Following the CKD procedure, BMW plants assemble cars on location out of imported parts kits, adding locally produced parts wherever possible to fulfil the respective government's local content requirements.

  It is inter alia for this reason that BMW has its own CKD plant in Thailand as well as further assembly plants together with external partners particularly in Asia.

  Internal production facilities also make sense in major sales markets if sales are not obstructed by customs barriers: A local plant makes the Company a local player, which in turn supports the acceptance of products in the country or region involved. The positive development of sales figures in the USA, South Africa and Great Britain ever since the establishment of fully-fledged production plants for BMW and MINI cars in the respective countries proves the success of this strategy. In all of these countries the BMW Group builds cars for the world market.

- **Natural hedging:** Production facilities and a large purchasing volume in major sales regions with different currencies serve additionally to balance off the flow of goods as well as currency fluctuations and risks.

An efficient, flexible, and agile production network is crucial to the implementation of the principle that “production follows the market”.

South Africa – BMW’s first step in becoming a global player.
Globalisation has been an essential feature of the BMW Group’s corporate strategy for more than three decades: BMW opened its first foreign plant in Rosslyn/South Africa as early as in 1973. Establishing this CKD plant and using local content from South Africa, BMW was able to avoid punitive taxes and therefore offer its products at competitive prices.

In the years to follow the Rosslyn Assembly Plant was developed step-by-step into a fully-fledged production plant, by 1997, comprising the core technologies body construction, application of the paint, and assembly. Today the BMW Rosslyn Plant is an illustrative example of successful penetration and development of the market by way of local production: To begin with, local production and the avoidance of high import duties ensured in this way served to significantly boost sales figures. After having overcome customs barriers and enhancing the plant to full production capacity, BMW has been building the 3 Series Sedan in South Africa for both the local market and worldwide exports. As an acknowledged local player, the South African Plant supports retail sales in the local market, which now accounts for annual customer deliveries of more than 20,000 BMWs in all model series.

BMW production in the USA – the gateway to the world’s largest sales market.
The decision taken in 1992 to build the BMW Group’s own production plant in the USA was an outstanding milestone in the history of the Company.
Up to the year 2004, just 12 years after the decision to build BMW’s new plant in Spartanburg/South Carolina, the BMW Group’s annual sales volume in the USA literally rocketed up from 50,000 to more than 260,000 units of BMW brand cars alone. This outstanding development was fuelled by local production, making the USA the world’s largest single market for BMW cars. Since the plant was opened in late 1994, the original production capacity has more than doubled, now amounting to more than 140,000 units a year.

Developing high-potential growth markets in Asia.

In the ’80s the BMW Group made its first move to Asia, where today, apart from two CKD assembly plants run jointly with external partners, the BMW Group also has its own CKD Plant in Rayong/Thailand.
Since 2004 the BMW Group has also had a plant in China: Here, in the market with the world’s largest growth potential, BMW has entered into a joint venture with Brilliance China Automotive Holdings Limited, building BMW cars in Shenyang for the Chinese market. Like in the USA, BMW is looking at greater penetration of the Chinese market in the long term, not least as a result of local production.

British heritage: Production of the MINI in Great Britain.

The MINI brand has been a highlight of British heritage for more than 40 years – and Great Britain is the largest single market for MINI cars.
The BMW Group’s decision to build the MINI in Oxford is not only a pledge to the identity of the brand, but rather consistently applies the successful strategy that “production follows the market”. With this in mind, the BMW Group will be investing another £ 100 million in Oxford from 2005–2007, preparing the plant in the medium and long term for the demands of both the brand and the market.

New BMW Leipzig Plant: A significant decision and commitment to Germany.

Germany and Europe remain the largest sales region for BMW to this day. And so it was only consistent and correct to build the new BMW plant in Europe. The decision taken in the ongoing process to build the facility in Germany proves that Germany, as an industrial base for production, is still highly attractive despite the high cost of wages and additional expenses in the country. Two other significant factors in this context are the very good infrastructure in Germany as well as the high level of training of the workforce available in the market.

2. Efficient Production: Flexibility Comes First.

Flexibility and operating in high-performance networks are the cornerstones of production by the BMW Group.

High flexibility ensured by "breathing structures".
To live up to its pledge as the leading manufacturer of premium cars, the Company must have an appropriate production network with "breathing structures" allowing a fast and flexible response to changes in the market and individual customer requirements: With competition becoming keener all the time, a crucial factor apart from product substance and quality is how quickly new products can be launched into the market and how reliably specific requests by the customer can be fulfilled. In addition, a high-performance production network must meet growing demand for individually produced cars as well as a wide range of individual variants and the complexity of both products and processes.

Flexible structures ensuring production at high capacity.
As a rule, every BMW Group Production Plant builds at least two models or variants allowing the plant to work to the highest possible standard of capacity even with demand for specific models fluctuating from time to time. Given their flexible structures, the plants are also designed to take up additional models in current production, thus expanding their overall production range.

The Dingolfing and Regensburg Plants are good examples of how such a "breathing structure" works: The BMW Dingolfing Plant focuses in particular of production of the 5, 6, and 7 Series. Whenever necessary, Dingolfing is able to build the BMW 3 Series currently manufactured primarily at the BMW Group's plants in Munich, Leipzig, Regensburg, and Rosslyn.

Precisely this was the case from 1998–2000, when the Dingolfing Plant showed a very high level of flexibility and provided the additional capacities required for production of the BMW 3 Series in response to great demand: Within just six months, the Plant took on additional production of approximately 70,000 units of the 3 Series a year. The BMW Regensburg Plant, in turn, builds the BMW 1 Series as well as individual variants of the 3 Series and the M3 in any random order on one and the same production line.

Flexible facilities and structures for easier integration of new models.
As a premium manufacturer, the BMW Group must recognise market and technology trends from an early point in the process of developing new models, operating with stable concepts and flexible structures in production. Assembly areas are therefore configured for the integration of new models and successors into existing structures without requiring any major conversion or substantial changes. Switching over from one model to another, therefore, does not involve any significant loss of production volume. And at the same time, derivatives in various model series can be integrated into existing facilities also at a later point in time.

The trend towards the "all-in-one" main assembly line.
A significant feature in flexible production is the "all-in-one" main assembly line. The most advanced technologies and logistic processes serve to pre-assemble specific components to the customer's requirements in a supply centre, forming modules delivered just-in-sequence to the main line in Assembly. This ensures even more flexible production of various models on the assembly line and allows plants to operate to their full capacity.

This concept is already being in use at BMW's Regensburg Plant and now sets new standards worldwide at the Leipzig Plant.

Innovative working time models for enhanced economy.
To operate economically, the production facilities at a plant must work to the highest possible level of capacity. Precisely this is what the BMW Group achieves through innovative working time concepts separating the associate's personal working hours from plant operating times and giving the Company the opportunity to respond flexibly to fluctuations in demand: While just 20 years ago automobile production plants generally worked a rigid 80 hours/ week, the introduction of working time accounts allowed plant operating times at the Regensburg Plant of 99 hours a week as early as in 1986.

One of the highlights developed for BMW's new Leipzig Plant is the BMW "Formula for Work" significantly enhancing the Plant's all-round productivity: With associates having an individual working week of 38 hours, this working time concept significantly increases the flexibility of the machines' operating times, thus setting off the disadvantage of higher wages and shorter personal working hours. Depending on requirements, the concept allows individual variation of operating times from 60–140 hours/week.

Cooperation with external partners supplementing the Plant's own resources.
To introduce specific products even more quickly and thus gain a growing competitive edge over the competition, the BMW Group also uses external networks. As an example, BMW has established a partnership with Magna Steyr Fahrzeugtechnik in the Austrian town of Graz in order to successfully introduce the BMW X3 as quickly as possible.

This cooperation takes the burden off the BMW Group's own structures, providing additional capacities and freedom within the Group's operations as such. Following the philosophy of the Company, brand-building know-how
as well as management and model assessment in terms of design, engine production, testing, purchasing and service all remain within the Company, ensuring that every BMW is really a genuine BMW.

3. Focusing on the Customer: Keeping Deadlines and Ensuring Maximum Flexibility in Change Management.

The BMW Group's **C**ustomer-**O**riented **S**ales and **P**roduction Process (COSP), which to this day sets the worldwide benchmark in the automotive industry, seeks to ensure maximum flexibility in change management, rapid action, and full maintenance of deadlines and delivery dates. COSP optimises the entire process chain from ordering all the way to the actual delivery of cars and motorcycles, naturally following the specific wishes and preferences of each and every customer.

Effective interaction in Production, Logistics and Sales allows each customer to take delivery of his or her personal, custom-built car at precisely the time agreed in advance.

The most important prerequisites for COSP are standardised processes in body construction, a high level of flexibility in production, as well as the Online Ordering System introduced in 1998. This system enables the dealer to show the customer his "dream car" on the screen, and to provide binding confirmation of both the production date and the time of delivery. Once the order has been made, a slot is reserved immediately in the production process and the Production Logistics Division is informed accordingly. COSP thus ensures a high level of transparency as well as stable supply and production processes both for internal network partners and for external suppliers.

Last-minute changes just six days before start of production.
A major advantage COSP offers the customer is the high level of flexibility in modifying his order. Indeed, the customer is able to make changes regarding the body variant, the engine, colour or equipment of his car at any time up to just six days before the start of assembly. And the impressive figure of more than 140,000 requests for change implemented each month – without a negative influence on the delivery date agreed – proves that the customer truly appreciates this flexibility.

The COSP principle is applied today to all BMW and MINI brand models, shortening the period from the inclusion of a specific model in the production schedule through the distribution process all the way to the actual delivery of the car to the dealer in the same country to just 10 days. Prior to the introduction of COSP, the time required for this process was up to 28 days.

Standardisation in body production – customisation in assembly.
With the introduction of COSP, the painted bodyshell is regarded in terms of logistics as an internal component supplied within the Company. One of the prerequisites of COSP was therefore to drastically reduce the number of body variants in the body production process: While the predecessor to the current 3 Series had up to 100 different floor pans, depending on the engine and the level of equipment, the current model comes with only four different body variants: left-hand drive, right-hand drive, with sliding roof, without sliding roof.

Following the painting process, the car bodies are kept in intermediate storage and are fed into the assembly process as soon as an order comes in for the respective body required. It is not until this point that the car is given a specific chassis number allocating it to a specific customer order. Shifting the process of customisation in this way to the assembly period, BMW is now able to consider any changes desired by the customer until shortly before the actual start of assembly.

Streamlined in this way, the new process chain is beneficial to both the customer and the Company: On the one hand, BMW production plants are able to consider short-term requests for change made by the customer without endangering the delivery date. On the other hand, the BMW Group benefits from the fact that customers making such changes often opt for a higher level of equipment, upgrading their car in the process. And last but certainly not least, COSP guarantees stable processes in logistics and production, not only within the BMW Group, but also with suppliers.

4. Business is People: The Associate as the Guarantee for Success.

Apart from mature operations and work processes as well as the most advanced plant technologies, the employee – or, to use the BMW term, the associate – plays a central role in the production of premium products by the BMW Group. Each and every associate is an important part of the complex production network and ultimately bears responsibility for the high quality of BMW Group products. A high level of self-responsibility, permanent, ongoing supervision of the associate's own level of quality in his or her work, as well as the wish and commitment to acquire greater qualifications for new jobs are all part of the BMW Group's corporate culture lived out by all associates day in and day out.

Forming an integral part of the BMW Group's "intelligent" network, the associate ensures an efficient transfer of knowledge beyond the confines of each individual plant. And through his or her commitment at a new plant or in the introduction of a new model, the associate helps to guarantee a punctual start of production with the high level of product quality rightly expected from the beginning.

The BMW Group – a most popular employer the world over.
Every international comparison shows that the BMW Group is one of the most popular employers in the world. This is also confirmed by the low turnover rate of associates as well as the number of more than 230,000 applications the Company receives each year.

Flexible working time models: Advantages for the employer and the associate.
More than 300 working time models, consistent participation in the success of the Company, job opportunities for associates in foreign countries, cooperation with colleges and universities, a comprehensive range of initial and further training opportunities, as well as the largest share of female associates throughout the entire automotive industry are only some highlights of the BMW Group's consistent and future-oriented human resources policy. This allows the Company, using machines and financial resources to their full capacity, to respond most flexibly to fluctuations in the market and, at the same time, to cater efficiently for the individual needs and preferences of associates.

The working time account is an important module in the context of BMW's overall working time philosophy. It allows plants to balance off seasonal and economic fluctuations and secure jobs on a long-term, sustained basis. Depending on the current workload, the associate is able to collect up to 200 hours either to his credit or debit subsequently set off in a later period.

This human resources policy pursued by the BMW Group is supplemented by further options such as flexitime, part time employment, job sharing, telework, as well as sabbaticals.

Individual models tailored to each location and associate.
BMW's Regensburg Plant, which introduced the first working time model as early as in 1986, is the pioneer in establishing flexible working time concepts within the BMW Group as a whole. Now the new BMW Plant in Leipzig is continuing this development, BMW's "Formula for Work" allowing infinite adjustment of operating times between 60 and 140 hours a week, depending on the number of orders on hand and the current workload.

BMW's Berlin Plant, to take another example, applies a different concept to meet seasonal fluctuations in motorcycle demand: In the first half of the year the Plant works longer shifts and has a longer working week, even using a four-shift model to significantly increase production capacity. Then, in the second half of the year, shift times are cut back and a four-day working week balances off the associate's working time account on an overall annual average.

5. The Successful Network: The BMW Group's Production Plants.

The BMW Group currently builds cars, motorcycles, components and other products at 22 locations in 12 countries. The production network comprises 8 car production plants for BMW automobiles and motorcycles as well as the Oxford Plant for MINI and the Rolls-Royce Manufacturing Plant in Goodwood, Great Britain.

Three Engine Production Plants in Austria, Britain, and Brazil, as well as the engine production facility at the Munich Plant, supply power units to the various car production operations.

This production network is supplemented by the production of components in Landshut, Swindon (Great Britain) and Eisenach. And wherever it makes sense, the BMW Group integrates external partners into the series production of individual models such as the BMW X3 built by Magna Steyr Fahrzeugtechnik in the Austrian town of Graz.

To avoid high customs barriers in individual markets with a significant growth potential, BMW builds cars for the local market in CKD ("completely knocked down") assembly plants, where imported CKD kits are supplemented by local components and materials. The 3, 5, and 7 Series, for example, are assembled by BMW at its own CKD Plant in Rayong/Thailand.

It almost goes without saying that the same high standards of quality, safety and the conservative use of resources apply to all BMW Group Plants the world over.

The production network: One for all – all for one.
While in the past the individual plants each sought to find the most advantageous solution for their own requirements, the focus today is on the network in its entirety: The various BMW Group Plants support and supplement each other, striving to find the most efficient solution for the network as a whole. And the network can only continue its process of development by applying best-practice solutions developed at a specific location as the standard to be achieved at all plants, implementing solutions beneficial to the network as a whole.

It is in this spirit that the individual plants support each other in ramping-up the production of new models. As an example, the BMW Regensburg Plant supported the MINI Plant in Oxford when starting and ramping up production of the MINI and the MINI Convertible. This was quite simply because the Regensburg Plant has a great deal of experience in ramping up new models thanks to the introduction of numerous derivatives of the BMW 3 Series,
and is especially experienced in the production of convertibles.

The BMW Group's production plants:

BMW Plant Munich, Germany.
Products: BMW 3 Series, 4-cylinder diesel engines, 6-, 8-, and 12-cylinder power units, M power units.

Built in 1922 on the northern outskirts of Munich, BMW's original plant started out with the production of BMW aircraft engines and motorcycles. Car production in Munich started in 1952, with more than seven million BMW automobiles coming off the production line ever since. The Munich Plant is the first plant ramping up production of the new BMW 3 Series in its fifth generation.

With its structure having grown significantly over the years, the Plant is now part of the Munich city area and is a direct neighbour of the BMW Group's Research and Innovation Centre. The Plant employs some 10,000 associates from more than 50 countries.

BMW Plant Dingolfing, Germany.
Products: BMW 5 Series, 6 Series, 7 Series, M5, M6.

To build up additional production capacities, BMW AG took over Hans Glas GmbH in 1967 and built a new car production plant in Dingolfing just three years later. Defying many doubts, the Plant started production of BMW cars in the very climax of the energy crisis back in 1973. Today the Dingolfing Plant employs some 22,000 associates and is the BMW Group's largest production facility. Using highly flexible processes and operations, the Plant is able to build the BMW 5 Series, the 6 Series, and the 7 Series all together on one and the same production line. Bodyshells for the Rolls-Royce Phantom are also built here in the Plant's Aluminium Centre of Competence, and Dingolfing produces chassis components for all BMW assembly plants. Last but not least, the BMW Group's Central Parts Shipping Division is an important facility in Dingolfing.

BMW Plant Regensburg, Germany.
Products: BMW 1 Series, 3 Series, M3.

Reflecting the great success of the BMW 3 Series, production capacities had to be expanded once again in the ’80s. Production in Regensburg started in 1986. Since then more than three million BMWs have come off the production line at the Regensburg plant which, introducing the very first flexible working time concept, has also set a new standard in the automobile industry:
With associates working four days a week and machines operating six days, the Plant has been able to increase the use of its machines and facilities by up to 30 per cent. Today some 10,000 associates (including Wackersdorf) build not only the BMW 1 Series, but also the 3 Series Sedan (incl. four-wheel drive), the Coupé, and the Convertible as well as the BMW M3 and BMW Individual Cars and cars for the authorities in BMW’s second-largest plant on one single main assembly line able to cope with all these variants.

BMW Plant Spartanburg, USA.
Products: BMW Z4, X5.

BMW’s Spartanburg Plant in South Carolina, USA, is the best example of BMW’s successful strategy of production following the market: Ever since the start of local production in Spartanburg in 1994, the USA has become the largest single market worldwide for BMW cars. Today some 4,600 associates build more than 500 BMW X5s and Z4s day in and day out. The Spartanburg Plant operates six days a week, with facilities remaining on line some 110 hours a week. A remarkable feature of the Plant’s structure is that the three core technologies (Body Production, the Paintshop and Assembly) are for the first time housed under one and the same roof.

BMW Plant Leipzig, Germany.
Products: BMW 3 Series.

BMW’s latest plant sets new standards through its building structure and architecture. The Bodyshop, Paintshop and Assembly are all grouped under one roof like a star around the Central Building, thus allowing ongoing growth in several directions. Making an initial investment of approximately 1.3 billion Euro, BMW has installed highly flexible plant structures as well as the most modern and advanced production facilities in the world. In the long term Plant Leipzig will be creating more than 5,000 jobs on its own premises alone.

Very flexible job structures in Leipzig allow infinite adjustment of operating hours from 60–140 hours a week, the Plant thus offering a very high level of flexibility making it able to build additional model series over and above the 3 Series if necessary.

A new feature in Leipzig is the layout and floorplan of the Assembly Hall. With its so-called finger or comb structure, the Plant is able to deliver components coming from outside just-in-sequence to the assembly line, without having to make any detours. A further advantage of this concept is that assembly can be expanded flexibly if required, without any major efforts. BMW Plant Leipzig is entering operation on 1 March 2005 with series production of the BMW 3 Series.

BMW Plant Rosslyn, South Africa.
Products: BMW 3 Series.

The Rosslyn Plant near Pretoria was BMW's first production plant outside of Germany. Opened as a CKD operation in 1973, the Rosslyn Plant built BMWs in all model series for the local market up to 1996. Then, with South African production being opened for export markets, the Plant was enhanced step-by-step, becoming a fully-fledged operation for the production of the BMW 3 Series Sedan by 1997. Today some 2,600 associates in Rosslyn build BMW 3 Series Sedans both for the local market and for worldwide exports, cars going to countries such as the USA, Japan, Australia, New Zealand, as well as the sub-Saharan region.

BMW Brilliance Automotive Shenyang, China (Joint Venture).
Products: BMW 3 Series, 5 Series.

BMW cars have been coming off the production line in north-east China at the Shenyang Plant since 2004. This fully-fledged production plant jointly operated with Brilliance China Automotive Holdings Limited comprises the three core technologies of body construction, paint application, and assembly processes in building BMW cars for the Chinese market. Local production is an important milestone for the BMW Group in developing the market with the world's largest growth potential.

BMW Plant Berlin, Germany.
Products: BMW motorcycles.

The BMW Berlin Plant is one of the BMW Group's most significant production facilities in terms of its long tradition: Like BMW's original plant in Munich, the history of the Berlin Plant started in 1939 with the production of aircraft engines. The production of motorcycle components began in 1949, with

motorcycle production being moved from Munich to Berlin in its entirety in 1969. Today the Berlin Plant builds up to 500 motorcycles a day in various model series with either one-, two- or four-cylinder power units. Since 1979 the workforce of approximately 2,600 associates has also been building components for BMW cars in Berlin, such as brake discs for various
BMW models.

BMW Group Plant Oxford, Great Britain.
Products: MINI One, Cooper, Cooper S, and MINI Convertible.

Some 4,500 associates in Oxford build the MINI to individual customer orders on no less than seven days a week. Since the market launch of MINI back in 2001, production – reflecting great demand from all over the world –
has increased from the planned volume of 100,000 units a year to almost 190,000 in 2004. And to prepare the Plant for the future requirements of
both markets and the MINI brand, the BMW Group is investing more than
£ 100 million in the further expansion and flexibility of MINI production
at the Oxford Plant by 2007, creating some 200 new jobs in the process.

Rolls-Royce Manufacturing Plant, Goodwood.
Products: Rolls-Royce Phantom.

The Rolls-Royce Manufacturing Plant uses the most advanced precision tools and technologies in support of the Company's great heritage of building cars by hand in perfect craftsmanship. Indeed, this combination of two outstanding strengths ensures a level of quality quite unique in the more than 100-year-old history of Rolls-Royce. Here a team of some 450 highly qualified specialists builds the Rolls-Royce Phantom according to each customer's most personal and individual requirements.

BMW Steyr Engine Plant, Austria.
Products: Six-cylinder petrol engines, four-and six-cylinder diesel engines.

Plant Steyr in Upper Austria was established in 1979 and is now the largest engine plant within the BMW Group. Steyr also acts as the Group-wide Development Centre for BMW diesel engines, the Plant supplying engines and engine components for all BMW model series to BMW's car and
engine production plants. Core engine components such as the crankcase, crankshaft, the cylinder head and the connecting rods are manufactured directly in Steyr, reflecting the skills and competence so characteristic of BMW engines with their top quality. More than 2,600 associates in Steyr build approximately 3,000 engines a day, with the BMW Group investing another 300 million Euro in the Steyr Plant as of 2005 for a further increase in
engine production capacity and flexibility.

BMW Hams Hall Engine Plant, Great Britain.
Products: Four-cylinder petrol engines.

The Hams Hall Engine Plant, where some 600 associates build all BMW four-cylinder petrol engines featuring fully variable VALVETRONIC valve management, has formed part of BMW's production network ever since 2001. currently Hams Hall delivers engines to the BMW plants in Munich, Regensburg, Leipzig, Rosslyn, and Spartanburg, and in future Hams Hall will also be assembling petrol engines for the next model generation of the MINI.

BMW Plant Landshut, Germany.
Products: Plastic components, light-alloy castings, propeller shafts, exchange engines.

At the Landshut Plant some 3,300 associates build engine components out of light-alloy castings, plastic components for interior and exterior use on BMW Group vehicles, as well as propeller shafts and exchange engines. The BMW Group's Formula 1 foundry is also located in Landshut.

Given this wide range of production, products from Landshut are to be found in virtually all BMW Group vehicles, and the Plant is also the home of the Landshut Innovation and Technology Centre. Last but not least, Landshut forms the link between vehicle development and components production, promoting the development of innovative materials and production processes.

BMW Plant Eisenach, Germany.
Tool production.

In Eisenach some 250 associates build tools for the production of medium-sized and large body panels. The Plant was opened in 1992 and has made a name for itself in the meantime also through the development of design models, prototype tools and components, as well as metal panels for small model series.

BMW Group Plant Swindon, Great Britain.
Products: Steel body pressings and components.

At the Swindon Plant some 1,500 associates build steel pressings for the body structure and the skin of the car. This is where, for example, the specific body components are made for the MINI Convertible then delivered as pre-assembled units to Plant Oxford. In the future MINI Production Triangle UK the Swindon and Hams Hall Plants will manufacture a large share of the body pressings and components as well as the entire range of petrol engines for production of the MINI in Oxford.

Production outsourced to Magna Steyr Fahrzeugtechnik, Austria.
Products: X3.

Production of the BMW X3 has been outsourced to Magna Steyr Fahrzeugtechnik in the Austrian town of Graz. To ensure production of the X3 in BMW's usual high standard of quality, Magna Steyr Fahrzeugtechnik has installed a special production line for the vehicle in accordance with BMW's demanding standards.

Curitiba Engine Plant, Brazil (Joint Venture).
Products: Four-cylinder petrol engines for MINI.

The petrol engines in the current generation of MINI come from the engine plant in Curitiba in the south of Brazil. This plant has been operated as a joint venture with DaimlerChrysler since 2001.

Completely Knocked Down (CKD) Assembly Plants.
Local production serves to circumvent trade barriers in major markets otherwise imposed by high import duties on completely built-up cars. In such cases BMW assembles cars in the completely knocked down process, BMW kits being supplemented by local parts and materials (local content). Naturally, such assembly processes follow the latest, demanding quality standards applied by the BMW Group as a whole.

Currently the BMW Group operates its own production facility in Rayong (Thailand), assembling the BMW 3, 5 and 7 Series. In Kaliningrad (Russia), Cairo (Egypt), Jakarta (Indonesia) and Kuala Lumpur (Malaysia), the BMW Group assembles both the 3 and the 5 Series in cooperation with external partners.

6. A Winning Team: Production and Development.

Development and Production cooperate very closely right from the start in a very early phase in the product creation process (PEP). Together, they share responsibility for the successful implementation of every vehicle project, as well as the quality and reliability of the cars delivered. A further advantage of this close cooperation from an early point in time is that each new car can be quickly integrated into the local production process, series production starting smoothly without any friction.

Smooth start of series production ensured by virtual trials.
Development of a new car and the production facilities required would be quite inconceivable today without the use of virtual tools such as computer-aided design and construction programs (CAD) as well as complex simulation models.

Digital data on the vehicle provided in this way is crucial in securing the right layout of facilities for production and virtually testing every production process and operation in advance.

The first point, however, is to verify whether a new model can be built at all in the manner and style desired. Examinations for this purpose are conducted initially on virtual models allowing the detection of critical points right from the start and thus ensuring that even the very first real-life prototypes come with a high level of maturity.

Virtual car production simulates the vehicle assembly process as well as maintenance and repair operations. CAD models of tools, facilities, plant structures and operations are examined in a virtual assembly environment and optimised in terms of their ergonomics before the facilities and plant operations are installed and built up.

7. Fit for the Future: Innovative Processes and Production Technologies.

BMW Group experts examine and develop exactly the right lightweight and materials concepts specifically for each vehicle project. In the process they focus on the need to save weight and energy, combined with design and functional benefits ensuring superior agility and driving dynamics.

In developing intelligent lightweight concepts the BMW Group, within its production and development network, is able to rely on a broad range of innovation, skills and competence in production, experience which has grown over the years, and superior mastery of even the most complicated processes.

Composite magnesium/aluminium components: The leader in technology thanks to in-house know-how in production.
Introducing the world's first composite magnesium/aluminium crankcase for the new generation of six-cylinder petrol engines, BMW has opened up a new chapter in engine technology: Despite the increase in engine output, the weight of the engine is down by approximately 10 kg or 22 lb compared with the former unit. The new crankcase is approximately 25 per cent lighter than a comparable component made of aluminium and a staggering 57 per cent lighter than a crankcase made of grey-cast iron.

With magnesium being extremely light but not suited for the cylinder liners nor as the material for a component coming into contact with coolants, BMW Group engineers have developed a composite structure comprising a magnesium outer case and an aluminium insert cast inside.

The production and process technology required for this purpose comes from the Landshut Innovation and Technology Centre at BMW's Landshut Plant, where the light-alloy foundry has been expanded for series production and equipped with pressure-casting machines among the largest in the world.

Formula 1 technology from Landshut and synergies for series development.
The BMW Landshut Plant proves its skills and competence in casting processes not just through the production of complex series components, but also through the production of engine components for Formula1: Both the crankcase and the cylinder heads for BMW's F1 power units are made at the ultra-modern foundry of the Landshut Sand Casting Technology Centre. The more than 5,000 individual components in an F1 power unit are the product of highly elaborate development processes and superior competence in process engineering coming mainly from the BMW Group's own resources.

F1 components are made in a sand-casting process due to significant freedom in design and a high standard of flexibility making subsequent changes possible in this case. To capitalise on potentials for ongoing improvement, BMW's engineers in the F1 foundry consistently develop new tools and processes. This also benefits series development and production, with the foundry acting also as a Prototype Centre for the development of new series components.

Carbon-fibre-reinforced plastics in the industrial production process.
The BMW Group is the leader in the development and production of body structures made of carbon-fibre-reinforced plastics (CFP). Indeed, this ultra-strong lightweight material is already being used in series production of the BMW M6, the process and production know-how required for this purpose coming from the Landshut Innovation and Technology Centre.

For the first time the BMW Landshut Plant builds the roof of the M6 in visible CFP in larger numbers in an automated production process. In this process several layers of carbon-fibre are first pre-moulded and cut in dry state, then being moistened with resin in the so-called RTM (resin transfer moulding) process, and finally being finished with a coat of clear paint on top. Offering the same strength on approximately 50 per cent less weight than a comparable component made of steel plate, the CFP roof is bonded on to the body of the car in the Bodyshop at the Dingolfing Plant.

The bumper supports of the BMW M6 are also made of CFP and are manufactured in a process developed in-house by the BMW Group in Landshut. Further lightweight components of this outstanding sports coupé are the front side panels made of thermoplastic as well as the rear lid made of SMC (sheet moulding compound) plastic, another special composite-fibre material.

Superior competence in the use of aluminium and innovative joining technologies.

The bodyshells of both the BMW 5 and 6 Series are a mixture of high-strength steel and aluminium, thus offering a perfect symbiosis of intelligent lightweight engineering and superior competence in production.
To ensure ideal weight distribution between the front and rear axle, the entire front section is made of aluminium.

This weight-reduced aluminium front section makes significant demands in production technology. To avoid corrosion otherwise caused by the direct contact of steel and aluminium, the front aluminium section and the steel body are connected to one another in the BMW Dingolfing Plant Bodyshop by means of insulating glue and specially coated punch rivets.

Mobile production cells for greater flexibility in body construction.

A special development by the BMW Group referred to as MobiCell or the Mobile Standard Production Cell allows the rapid and cost-efficient transfer of production cells in body construction. This also provides the option to combine individual cells with one another, forming larger and more complex production units in the process. This, in turn, gives the Bodyshop the opportunity to start production of a different or an additional model within
a relatively short period, or to transfer individual cells from one location
to another.

All-in-one main line for greater flexibility in assembly.

Due to the large range of model variants, the assembly of different models often leads to significant fluctuations in the assembly periods required.
And since the models built are constantly becoming more complex, it is becoming increasingly complicated in conventional structures to really
master the processes involved with the necessary degree of efficiency.

Using new assembly structures and concepts, the BMW Group is able to overcome difficulties of this kind and streamline processes by separating assembly and logistic functions so far housed under one and the same roof.
In future, therefore, the Assembly Building will house primarily the “all-in-one” main assembly line as well as the Testing and Finish Area. Individual assembly operations specific to different customers and involving a large number
of body variants will be grouped in specific modules and pre-assembled at Supply Centres, thus cutting back the sometimes large fluctuation of assembly periods on the main line. A further advantage is that this allows even more flexible production of several models on the main assembly line, enabling production plants to work even more efficiently and with even higher capacity.

8. Sustainable Production: BMW's Concept of Clean Production.

To be successful in the long term, a company must show responsibility also to ecological requirements and assume a social commitment. With this in mind, the BMW Group is convinced that sustained management and corporate success go hand-in-hand with one another. Precisely this is why the BMW Group integrates principles of sustainability into the Company's everyday routines, which, in Production, means careful maintenance of demanding environmental standards and the conservative use of resources.

The forerunner in international environmental management.
In 1999 the BMW Group became the first company in the automotive industry to certify all its production plants and locations worldwide to consistent environmental and quality standards. In addition, the BMW Group is the first and, so far, only automobile manufacturer to apply not only the same international environmental standards at all its plants, but also to tailor these standards to the requirements of the respective location in accordance with Agenda 21.

Clean Production – the BMW Group's sustained production strategy.
The BMW Group has committed itself to implement the philosophy of Clean Production, that is car production helping to preserve the environment, as the guiding principle in BMW's own production processes. By "Clean Production", the Company means capitalising on technically, economically, and ecologically sensible options in establishing and maintaining an effective production process beneficial to the environment.

Forming part of the BMW Group's international environmental guidelines, Clean Production is lived out by all associates every day – whether through their responsible and efficient use of resources or through production processes optimised for ecological requirements. In addition, the BMW Group is working hard on the environmental design of its products and, in the
long term, on the series development of trendsetting drive concepts such
as the hydrogen engine.

Sustained production by the BMW Group does not end at the gates to our plants. On the contrary – the selection and appointment of suppliers considers not only their qualities and technical competence, but also social and ecological aspects and, as a result, the proper maintenance of criteria essential for production compatible with the environment.

Examples of the conservative use of resources.
Production accounts for approximately one-third of all waste water within the Company as a whole. And precisely here the BMW Group has succeeded in significantly reducing water consumption by means of closed, self-contained cooling circuits, using water in specific circulation processes, and introducing efficient waste water treatment facilities. The positive effects are further enhanced by trendsetting technologies such as the application of clear powder paint, a process leaving neither waste water nor cleaning agents or solvents behind. This technology highly compatible with the environment is already in use at the Dingolfing, Regensburg and Leipzig Plants.

Since the year 2000, the BMW Group has succeeded in reducing the amount of waste water in production as well as the consumption of process water per vehicle by approximately 25 per cent (2000: 1.06 cubic metres of process waste water per unit manufactured; 2004: 0.79 cubic metres). Introducing water-based filler paint, the BMW Dingolfing Plant has succeeded, while improving product quality, in saving up to 40 tonnes of solvents a year in the production of the 5 Series alone.

Apart from production facilities with a high level of efficiency, the BMW Group is looking increasingly at technologies switching individual power-consuming items on and off individually as required. In addition, heat recycling facilities, the use of heat discharged, and the generation of low temperatures in absorption facilities help to cut back the consumption of primary energy.
The bottom line following from all these improvements is that energy consumption per unit manufactured has decreased in the last four years by 13.3 per cent, with CO_2 emissions down by 15.3 per cent.